AGE STRUCTURE OF ANTARCTIC KRILL (*EUPHAUSIA SUPERBA*) POPULATIONS AS DETERMINED BY AGE-PIGMENT ANALYSIS AND BY SIZE-FREQUENCY ANALYSIS

Morphometric measurements and size frequency analysis have conventionally been used to assess the age structure of crustacean populations. Certain crustaceans have, however, not proven amenable to such analyses. For example, laboratory studies have shown that the Antarctic krill *Euphausia superba* can live for 7–8 years (Ikeda and Thomas, 1987), a life-span far in excess of that predicted from morphometric determinations. Furthermore, this species may decrease in size during periods of low food availability (Ikeda and Dixon, 1982) thus obscuring the relationship between measurements of body size and age. In response to these problems, an age-determination technique was developed for *E. superba* which was based on the measurement of levels of age-pigments (FAPs) in the animals (Ettershank, 1983, 1984a, b, 1985).

Early work on FAPs held promise (Ettershank, 1983, 1984a, 1985) but subsequent studies demonstrated methodological problems (Nicol, 1987). Studies examining FAPs in other organisms have yielded equivocal results (Hill and Radtke, 1988; Hirche and Anger, 1987) but the utility of this technique for aging populations of the species for which it was originally proposed — *Euphausia superba* — is yet to be proven.

A population of juvenile *E. superba* was maintained under constant laboratory conditions. A sample of the population was removed at the start of the experiment and the animals were frozen individually in liquid nitrogen. The surviving animals from the original population were frozen in liquid nitrogen one year later. The two sets of samples were analysed for FAPs (Ettershank, 1984b) and the mean fluorescence peak heights of the two groups were compared. The results of the fluorescence technique were compared with those of a more conventional weight-frequency analysis.

The mean fluorescence (expressed as relative fluorescence or as weight specific relative fluorescence) of the year 2 group was significantly greater than that of the year 1 group. In contrast, the mean weight of the individuals in the population decreased significantly over the course of the year (Table 1). The weight and relative fluorescence data were pooled, simulating the normal field situation of a series of frequency data from which peaks must be discerned. In this instance the number of year classes and the mean peak heights were known so the results from the frequency analyses could be compared to the expected (real) case. An analysis of the weight specific relative fluorescence data by the Macdonald-Pitcher method yielded a best fit for two modal peaks, the means of which were not significantly different to the known means for the two year classes. The weight-frequency analysis also yielded a best fit for two peaks but in this case the correspondence between the means of the predicted and known weight groups was not so precise or accurate.

These results show that under laboratory conditions it is possible to separate year groups of *E. superba* by FAP quantification and that the accumulation rate over a period of one year is great enough that the year groups can be discriminated even when the data are pooled. We have also shown that FAPs can be used to demonstrate year group separation and predict which group is older when size-frequency analysis gives the wrong answer.

TABLE 1. The mean values and predicted mean values for the weight specific relative fluorescence and the dry weight of the animals in each sample.

	Year 1	Year 2
Fluorescence	133.286	213.873
Mean wt. specific fluorescence	10.625 (9.53)	21.10 (20.42)
Mean dry weight	13.286 (19.34)	9.926 (9.65)
number of samples	37	23

Comparison between mean weight specific fluorescence in year 1 and year 2: $t = -7.586$, 58 df, $p < 0.0001$.

Comparison between mean dry weight in year 1 and year 2: $t = 2.522$, 58 df, $p = 0.014$.

Values in brackets are predicted means from Macdonald-Pitcher analyses of combined year 1 and year 2 data sets.

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